REMARKS / ARGUMENTS

I. General Remarks and Disposition of the Claims

Please consider the application in view of the following remarks. Applicant thanks the Examiner for the careful consideration of this application including the references that Applicant has submitted in this case.

At the time of the Office Action, claims 1-30 were pending in this application. Claims 1-3, 7-18 and 22-30 were rejected in the Office Action. Claims 4-6 and 19-21 were objected to in the Office Action as being dependent upon a rejected base claim, but allowable if rewritten in independent form. Claims 11 and 26 have been amended herein. These amendments are supported by the specification as filed. All the amendments are made in a good faith effort to advance the prosecution on the merits of this case. It should not be assumed that the amendments made herein were made for reasons related to patentability. Applicant respectfully requests that the above amendments be entered and further request reconsideration in light of the amendments and remarks contained herein.

II. Remarks Regarding Rejections Under 35 U.S.C. § 112

Claims 11 and 26 stand rejected under 35 U.S.C. § 112, first paragraph. With respect to this rejection the Office Action states:

> Claims 11 and 26 recite "a log-log graph of a pressure function versus time: $I(\Delta p)=f(\Delta t)$", it is unclear which function represents the pressure function. Further, "I" is undefined and is therefore unclear what "I" represents. Further still, Applicant has defined $I(\Delta p)$ to be equal to both $f(\Delta t)$ and it is unclear if $f(\Delta t)$ is also equal to $\int_{a}^{a} \Delta p \, d\Delta t$. Even further still, in $\int_{a}^{a} \Delta p \, d\Delta t$ it is unclear if the Applicant intends to integrate Δp times Δt or Δp times $d\Delta t$; in either case neither Δp nor $d\Delta t$ has been defined.

Office Action at 2.

Claims 11 and 26 have been amended herein to recite that $I(\Delta p)$ is a pressure function and Δt represents time. Moreover, the equation has been amended to clarify that it is Δp times $d\Delta t$ which is being integrated. Finally, as would be appreciated by those of ordinary skill in the art and disclosed in the specification (e.g. page 37), $d\Delta t$ refers to the mathematical

operation of taking the derivative of Δt. Accordingly, the Applicant respectfully requests a withdrawal of these objections.

III. Remarks Regarding Rejections Under 35 U.S.C. § 103(a)

Claims 1-3, 7-9, 13-18, 22-24 and 28-30 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,904,366 issued to Patzek et al. (hereinafter "Patzek") in view of NPL entitled "Analysis of pressure and pressure derivative without type curve matching, 4. Naturally fractured reservoirs" by Engler et al. (hereinafter "Engler"). With respect to the rejection of independent claims 1, 15 and 28, the Office Action states:

> Regarding claim 1, Patzek et al. teaches:
>
> A method of detecting a fracture with residual width from a previous well treatment during a well fracturing operation in a subterranean formation containing a reservoir fluid (see waterflooding, column 1 lines 29-55), comprising the steps of:
>
> (a) injecting an injection fluid into the formation at an injection pressure exceeding the formation fracture pressure (see "injecting water or other fluids," column 1 lines 32-34; see also "excess injector pressure is used..." (i.e. exceeding the formation fracture pressure), column 1 lines 45-50; see also water injection, column 5 lines 28-33);
>
> (b) gathering pressure measurement data from the formation during the injection and a subsequent shut-in period (see "a time measurement device, a pressure measurement device...," column 2 lines 54-55; see also column 2 lines 10-17; see also MEMS sensors, column 5 lines 60-63; see also column 6 lines 35-36);
>
> (c) transforming the pressure measurement data into a constant rate equivalent pressure (see "variable injection pressure and transformed it to an equivalent simpler form," column 20 lines 20-33 (an equivalent simpler form is interpreted to be a constant rate equivalent pressure);
>
> Patzek et al. differs from the claimed invention in that it does not explicitly teach (d) detecting the presence of a dual unit-slope wellbore storage in the transformed pressure measurement data, said dual unit-slope being indicative of the presence of a fracture retaining residual width.
>
> Engler et al. teaches direct synthesis for interpreting pressure transient tests in naturally fractured reservoirs that includes the effect of the wellbore storage (Abstract).

. . .

Regarding claim 15, Patzek et al. teaches:

A system for detecting a fracture with residual width from a previous well treatment during a well fracturing operation in a subterranean formation containing a reservoir fluid, comprising:

- a pump for injecting an injection fluid at an injection pressure exceeding the formation fracture pressure (means for pumping water is interpreted to be a pump, see column 1 lines 49-51; see also pump pressure, column 39 lines 37-39; see also "excess injector pressure is used..." (i.e. exceeding the formation fracture pressure), column 1 lines 45-50);

- means for gathering pressure measurement data in the wellbore at various points in time during the injection and a subsequent shut-in period (see "a time measurement device, a pressure measurement device...," column 2 lines 54-55; see also column 2 lines 10-17; see also MEMS sensors, column 5 lines 60-63; see also column 6 lines 35-36);

- processing means for transforming said pressure measurement data into a constant rate equivalent pressure (a computer, especially microprocessor or digital signal processor, is interpreted to be a processing means for transforming, see computer, column 4 line 65-column 5 line 7; see also "variable injection pressure and transformed it to an equivalent simpler form," column 20 lines 20-33 (an equivalent simpler form is interpreted to be a constant rate equivalent pressure); see also means for analyzing and manipulating, column 6 lines 19-28);

Patzek et al. differs from the claimed invention in that it does not explicitly teach means for detecting the presence of a dual unit-slope wellbore storage in the transformed pressure measurement data, said dual unit-slope being indicative of the presence of a fracture retaining residual width.

Engler et al. teaches direct synthesis for interpreting pressure transient tests in naturally fractured reservoirs that includes the effect of the wellbore storage (Abstract).

. . .

Regarding claim 28, Patzek et al. teaches:

A system for detecting a fracture with residual width from a previous well treatment during a well fracturing operation in a subterranean formation containing a reservoir fluid, comprising:

- a pump for injecting an injection fluid at an injection pressure exceeding the formation fracture pressure (means for pumping water is interpreted to be a pump, see column 1 lines 49-51; see

> also pump pressure, column 39 lines 37-39; see also "excess injector pressure is used..." (i.e. exceeding the formation fracture pressure), column 1 lines 45-50);
>
> - means for gathering pressure measurement data in the wellbore at various points in time during the injection and a subsequent shut-in period (see "a time measurement device, a pressure measurement device...," column 2 lines 54-55; see also column 2 lines 10-17; see also MEMS sensors, column 5 lines 60-63; see also column 6 lines 35-36);
>
> - processing means for transforming said pressure measurement data into a constant rate equivalent pressure (a computer, especially microprocessor or digital signal processor, is interpreted to be a processing means for transforming, see computer, column 4 line 65-column 5 line 7; see also "variable injection pressure and transformed it to an equivalent simpler form," column 20 lines 20-33 (an equivalent simpler form is interpreted to be a constant rate equivalent pressure); see also means for analyzing and manipulating, column 6 lines 19-28); and
>
> - graphics means for plotting said transformed pressure measurement data representative of before and after closure periods of wellbore storage (the means for plotting is interpreted to be graphics means for plotting said transformed pressure measurement data, see for example, Figs. 2A-12).
>
> Patzek et al. differs from the claimed invention in that it does not explicitly teach detecting a dual unit-slope wellbore storage indicative of the presence of a fracture retaining residual width.
>
> Engler et al. teaches direct synthesis for interpreting pressure transient tests in naturally fractured reservoirs that includes the effect of the wellbore storage (Abstract).

Office Action at 3-4, 7-8, 10-11. Applicant respectfully disagrees.

In order for a reference or combination of references to form the basis for a rejection under § 103(a), a *prima facie* case of obviousness must be established. Obviousness is determined by construing the scope of the prior art, identifying the differences between the claims and the prior art, determining the level of skill in the pertinent art at the time of the invention, and considering objective evidence present in the application indicating obviousness or nonobviousness. *Graham v. John Deere*, 383 U.S. 1, 17 (1966). The United States Supreme Court has identified a number of rationales under which a prima facie case of obviousness may be established. *See KSR International Co. v. Teleflex, Inc.*, 550 U.S. 398, 127 S.Ct. 1727, 1731

(2007). Each rationale is directed towards identifying known elements in the prior art. *See* MPEP § 2143. Applicant respectfully submits that due to the differences between the claims and the cited references the Office Action has not established a *prima facie* case of obviousness, in that the combination of Patzek and Engler does not establish that each limitation of the present claim was known in the prior art.

The Examiner acknowledges that Patzek fails to disclose detecting the presence of a dual unit-slope wellbore storage in the transformed pressure measurement data and relies on Engler as teaching that limitation. Office Action, at 4. However, the combination of Patzek and Engler fails to teach or suggest "injecting an injection fluid into the formation at an injection pressure exceeding the formation fracture pressure," "transforming the pressure measurement data into a constant rate equivalent pressure" and "detecting the presence of a dual unit-slope wellbore storage in the transformed pressure measurement data" as recited by independent claims 1, 15 and 28.

Patzek "relates to a method and/or hardware implementation of a method for controlling well injection pressures for at least one well injector used for secondary oil recovery by waterflooding." Patzek, Col. 1, lines 22-25. The Examiner relies on the following portions of Patzek for disclosing "injecting an injection fluid into the formation at an injection pressure exceeding the formation fracture pressure":

> The waterflooding process uses fluid injection to transport residual oil remaining from initial primary oil production to appropriate producers for extraction. Col. 1, lines 32-35.
>
> When excess injector pressure is used, the geological strata (or layer) containing the oil can be crushed (or hydrofractured). The growth of such hydrofractures can cause a direct conduit from an injector to a producer, whereby no further oil is produced, and water is simply pumped in the injector, conducted through the hydrofractured conduit, and recovered at the producer through a process known as "channeling." At this juncture, the injector is no longer useful in its function, and is now known as a failed, dead, or lost well. Col. 1, lines 45-55.

Accordingly, the recited portions of Patzek do not disclose "injecting an injection fluid into a formation at an injection pressure exceeding the formation fracture pressure." Instead, Patzek generally states that the use of excess injector pressure (which is not defined in

relation to the formation fracture pressure) can lead to undesirable results such as a dead or lost injector well. The Applicant does not find a teaching of this limitation in other portions of Patzek.

Moreover, the Examiner relies on the following portion of Patzek for teaching "transforming the pressure measurement data into a constant rate equivalent pressure":

> Above, we considered a model of transient fluid injection into a low-permeability rock through a vertical hydrofracture. We arrived at a model describing transient fluid injection into a very low permeability reservoir, e.g., diatomite or chalk, for several years. We have modified the original Carter's model (Howard and Fast, 1957) of transient leak-off from a hydrofracture to account for the initial fracture area. We also have extended Carter's model to admit variable injection pressure and transformed it to an equivalent simpler form. As a result, we have arrived at a Volterra integral convolution equation expressing the cumulative fluid injection through the history of injection pressure and the fracture area (Patzek and Silin, 2001), Eq. (24).

Patzek, Col. 20, lines 20-33 (emphasis added). The examiner notes that the "equivalent simpler form is interpreted to be a constant rate equivalent pressure." Office Action at 4. The Applicant respectfully disagrees with the Examiner's characterization.

The recited portion of Patzek merely discloses that Carter's model has been extended to admit variable injection pressure and that the Carter's model has been transformed into an equivalent simpler form. (emphasis added). In fact, with respect to Equation 24, Patzek provides:

> Eq. (24) states the following. Current injection rate cannot be determined solely from the current fracture area and the current injection pressure; instead, it depends on the entire history of injection. The convolution with 1/√t-.tau. implies that recent history is the most important factor affecting the current injection rate. The last conclusion is natural. Since the fracture extends into the formation at the initial pressure, the pressure gradient is greater on the recently opened portions of the fracture.

Patzek, Col. 16, lines 8-16. In Patzek, the parameter q(t) refers to injection rate as a function of time and Q(t) refers to cumulative injection as a function of time. Patzek, Col. 6, lines 60-65; Col. 16, line 7; Col. 16, lines 32-33. Accordingly, the recited portions of Patzek merely provide equations relating to the injection rate and cumulative injection as a function of time and are silent with respect to transforming the pressure measurement data into a constant rate equivalent

pressure as recited in independent claims 1, 15 and 28. Similarly, the Applicant does not find a teaching of this limitation in the remaining portions of Patzek.

Moreover, Engler fails to disclose that which Patzek lacks. Engler is directed to a direct synthesis method for interpreting pressure transient tests in naturally fractured reservoirs. Engler, Abstract. Applicant does not find a teaching of the missing elements of Patzek in Engler. Rather, the Office Action merely relies on the secondary reference for its alleged teaching of "detecting the presence of a dual unit-slope wellbore storage in the transformed pressure measurement data, said dual unit slope being indicative of the presence of a fracture retaining residual width." Moreover, Engler does not disclose that variable storage can occur. Nor does Engler disclose how a closing fracture and residual fracture width contribute to variable storage. Accordingly, the combination of Patzek and Engler fails to establish that every limitation of independent claims 1, 15 and 28 was known in the prior art.

Therefore, Applicant respectfully asserts that independent claims 1, 15 and 28 are not rendered obvious by the combination of Patzek and Engler. Claims 2, 3, 7-9, 13, 14, 16-18, 22-24, 29 and 30 depend from independent claims 1, 15 and 28 and are allowable for at least the same reasons. Accordingly, Applicant respectfully requests withdrawal of these rejections.

Claims 10, 12, 25 and 27 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Patzek and Engler as applied to claims 9 and 27, further in view of NPL entitled "Estimation of static formation temperatures in geothermal wells" by Espinosa-Paredes et al. (hereinafter "Espinosa-Paredes"). Claims 10 and 12 depend from independent claim 1 and claims 25 and 27 depend from independent claim 15. As discussed above, Patzek and Engler fail to disclose all limitations of independent claims 1 and 15. Espinosa-Paredes fails to disclose that which Patzek and Engler lack. Specifically, Espinosa-Paredes is directed to an analysis of temperatures in geothermal wells. Espinosa-Paredes, Title & Abstract. The Applicant does not find a teaching of "injecting an injection fluid into the formation at an injection pressure exceeding the formation fracture pressure," "transforming the pressure measurement data into a constant rate equivalent pressure" and "detecting the presence of a dual unit-slope wellbore storage in the transformed pressure measurement data" in Espinosa-Paredes as recited in independent claims 1 and 15. Accordingly, independent claims 1 and 15 are allowable over

Patzek, Engler and Espinosa-Paredes. Claims 10, 12, 25 and 27 depend from independent claims 1 and 15 and are therefore allowable for at least the same reasons.

IV. Allowable Subject Matter

In the Office Action, the Examiner noted that claims 4-6 and 19-21 would be "allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims." (Office Action at 16.) Applicant gratefully acknowledges the Examiner's indication that claims 4-6 and 19-21 would be allowable if rewritten in independent form. Since Applicant has traversed the rejections of claims 1 and 15, which are the base claims of claims 4-6 and 19-21, Applicant respectfully submits that claims 4-6 and 19-21 are allowable as well.

V. No Waiver

All of Applicant's arguments and amendments are without prejudice or disclaimer. Additionally, Applicant has merely discussed example distinctions from the cited references. Other distinctions may exist, and Applicant reserves the right to discuss these additional distinctions in a later Response or on Appeal, if appropriate. By not responding to additional statements made by the Examiner, Applicant does not acquiesce to the Examiner's additional statements, such as, for example, any statements relating to what would be obvious to a person of ordinary skill in the art.

SUMMARY

In light of the above amendments and remarks, Applicant respectfully requests reconsideration and withdrawal of the outstanding rejections. Applicant further submits that the application is now in condition for allowance, and earnestly solicits timely notice of the same. Should the Examiner have any questions, comments or suggestions in furtherance of the prosecution of this application, the Examiner is invited to contact the attorney of record by telephone, facsimile, or electronic mail.

Applicant believes that no fees are due in association with the filing of this response. Should the Commissioner deem that any fees are due, including any fees for extensions of time, Applicant respectfully requests that the Commissioner accept this as a Petition therefor and direct that any additional fees be charged to Baker Botts, L.L.P.'s Deposit Account No. 02-0383, Order Number 063718.0371.

Respectfully submitted,

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By: _____

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